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Wisconsin Geological Survey reports

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Geological report, 1854, <1860>

Annual report on the Geological Survey of the State of Wisconsin, 1855-1856

Report, 1857

Report of the Commissioners of the Geological Survey, <1858>

GEOLOGICAL REPORT.

ALBANY, December 24th, 1860.

TO HIS EXCELLENCY, ALEXANDER W. RANDALL :

SIR:—In accordance with the law authorizing a Geological Survey of the State of Wisconsin, I herewith submit a statement of the condition of the work under my direction :

I have personally continued my field explorations; with a view to the determination of the general geological structure of the State, and have made good progress in these investigations.

Among the results of general interest, I may mention that in carrying on my observations to the northwestward of the westerly bend of the Wisconsin River, among the isolated masses of sienitic rocks which have been regarded as of igneous origin, I have found many of them to be essentially quartz rocks of peculiar character. These rocks I find on more careful examination in several localities, to have been originally a regularly stratified sandstone, which has undergone subsequent metamorphism, so far, that on fresh fracture the rock betrays no lines of lamination. When viewed as a whole, or in the massive ~~interiors~~ the lines of nearly vertical jointing are conspicuous; but lines of bedding or stratification, are not at once recognized. In certain localities in favorable conditions, and particularly on Spirit Lake, we find the weathered surfaces showing distinct lines of lamination; and not only the direct lines are visible, but lines of diagonal lamination at various angles, and the coarser and finer materials are as discernable as in modern sandstones.

Not only, therefore, have we this unmistakable evidence of the stratified character of these rocks, but we have the means of showing that the direction of the foldings or axes (which through the denudation of the more recent formations, has brought these rocks to view,) lie in a nearly east and west direction, and therefore belong to an entirely different system from those which have affected the superincumbent strata.

After determining, by the more minute and detailed examinations, the stratified nature of these rocks, we are able to discover in the larger masses, and the hill escarpments the direction and dip of the strata, which are extremely obscure, and rendered more difficult of observation by the numerous joints. Besides these determinations, I have in two or three localities been able to trace these quartzites upward till the beds become conglomeritic; the pebbles consisting of the crystalline quartz, (usually of a brown color,) which vary from the size of peas to a foot or more in diameter. The darker materials gradually become mixed with a lighter colored sand, and sometimes a notable proportion of argillaceous matter; the mass loses its metamorphic aspect, and we find ourselves almost imperceptibly investigating the base of the Potsdam sandstone.

It must not be understood, however, that there is any passage from the one to the other that would indicate a synchronism of the two formations. On the other hand, the quartzite had been deposited as a coarse and fine sand, (with sometimes pebbles, had become metamorphosed and the mass raised in low axes before the commencement of the Potsdam era. The breaking up of this mass gave the pebbles of quartz, etc., which lie at the base of the Potsdam sandstone; and these pebbles, with an accumulation of sand from the breaking up of the mass continue the color and aspect of the rock below, till the influx of lighter colored sand changes the character and color of the whole.

I regard this discovery of the nature of these underlying masses to be a matter of considerable interest; and since the areas occupied by such rocks are limited, and it is nearly impossible to trace a connection between any two of them, it becomes important to collect material from numerous localities, for the purpose of comparison with the more extended areas of older metamorphic rocks.

These metamorphic masses are, in all probability, extensions of the Huronian formations of Canada; and though not familiar with the latter in its typical localities, I am inclined to refer them to that period, since they do not correspond with the Laurentian rocks known to me through investigations in northern New York.

I have considered these facts of sufficient interest to the science of Geology and to the survey to communicate them in the present report. I shall continue this investigation, and hope to be able hereafter to show the relations of all these metamorphic masses to formations of known geological age.

In addition to these observations, I have pursued my investigations upon the Potsdam sandstone and the succeeding formations; which, with the previous researches will be fully detailed in the final report.

The investigations upon the rocks of the Niagara group and associated strata, have likewise been continued, and I have arrived at certain results fortified by the occurrence of numerous fossils which lead me to conclude that the Racine limestone, mentioned in a former report, is the upper member of the Niagara group, while the heavy bedded mass below is but the expansion of the limestones of the Clinton group. This opinion in regard to the last named rock I advanced some years since, but having until this time no satisfactory evidence of the occurrence of the higher member of the Niagara group, I had been forced to admit that the whole had merged in one great calcareous mass. This part of the subject will be more fully discussed in my next report.

I have had an assistant, Mr. T. J. Hale, in the field from the beginning of July to the end of the season. His labors have been directed to tracing in detail the outcrops of the formations on the east of the central axis, and in collecting fossils. He has also collected economic materials and soils for the other departments of the survey. During the latter part of the season Mr. Hale has been employed in the lead region to complete the collection of fossils necessary for the palaeontology of that report, which is now being prepared.

Under the supplementary law of last session, relating to the geology of the State, I was directed to make a contract with Prof. J. D. Whitney for the completion of the map and report of the lead region; and with Col. Charles Whittlesey for the continuation of his work in the Lake Superior region. In accordance with this law, and with the approval of your Excellency, these contracts were made, and the work continued. Since that time Mr. Whitney has completed his report and maps, which, by the terms of the act referred to, have been placed in the engraver's hands, and I hope to send finished copies of one of them with this report. The other map will require yet some time for its completion. I have also made arrangements for, and progress in, the work pertaining to other illustrations for this report. The report of Mr. Whittlesey will soon be completed and placed in my hands, and will be subject to your direction.

Mr. Hale will communicate to me a detailed report upon his local examinations, which may be incorporated in my final report.

While the general work of my department of the survey has been progressing in these investigations, the collecting of fossils from the various rocks, etc., I have been giving more especial attention to the preparation of the report upon the lead region. According to the plan heretofore proposed, my report will embrace a general sketch of the geology of the State, showing the relations of the lead bearing rock to the other formations of the State, and the whole in relation to the geology of the adjacent country, so far as now known. This will be followed by the special report of Mr. Whitney on the geology, mineralogy, mining, etc., of the Lead Region with illustrations and diagrams, besides two large maps. The concluding part of the report will be the descriptions of fossils, or the palaeontology of the Lead Region, which will make the work complete for that part of the State.

The maps for this report, with some other of the illustrations, will be engraved from money derived from the surplus of the previously unappropriated fund, directed by the law of the last Legislature to this object, after completing the contract with Messrs. Whitney and Whittlesey. I have, however, made no arrangement for the printing of any definite number of these maps or illustrations, beyond what may be necessary as examples of the work.

In order, therefore, to accomplish the printing of these, I require further means and authority.

The entire report on the lead region will be sufficient to make a large octavo volume of 600 or 700 pages, with several maps, and at least thirty or more plates of fossils. The work of engraving may be so far completed that the text of this volume will be ready for the press by the beginning of April next. I mention this time because nothing would be gained by commencing the printing sooner, since the engraving and printing of the plates and maps could not be ready sooner than in time for the letter press, if begun at that date.

I have spoken and written to your Excellency upon the subject of the printing, which I hope may be done in a better style than the ordinary documents. The report will be a final one upon that portion of the State, and a volume of much value and importance. I hope the Executive and Legislature of Wisconsin will not be satisfied with anything below the standard of the Iowa Report. I may, perhaps, be permitted to mention here, that the style and size of the Iowa report has been adopted in the Illinois survey, as I am informed by the State Geologist, and that the forthcoming report will be printed in that form.

In addition to the report on the lead region, I shall have in my hands the reports of Col. Whittlesey for 1858 and 1860; these, however, are to be considered as reports of progress upon work yet unfinished, and to complete in detail the investigations in the Lake Superior region, will require much more time and means.

I append herewith the descriptions of some new species of fossils from the rocks of the lead region, which I am desirous of having printed in advance of the final report upon that part of the State. There are also some species from rocks of the age of the Niagara group in the eastern part of the State, which I wish to have printed as early as practicable.

I shall be able to render an account of expenditures in the survey, as soon as I shall receive the report and final account of Mr. Whittlesey, and the account of Mr. Hale.

Mr. Whitney has already been paid the full amount of his contract, \$2,500. Mr. Whittlesey has received \$1,000. I have drawn on account of engraving maps, etc., \$500. These sums have been drawn from the unexpended or undrawn appropriation for the Geological Survey, the expenditure of which was directed at the last session of the Legislature.

In everything pertaining to the completion of the work in my charge, I have used my utmost endeavors to make the most efficient progress that the limited means at my disposal will permit, and to bring out the results in a satisfactory manner.

I have the honor to be

Very respectfully,

Your ob't servant,

JAMES HALL,

State Geologist.

GEOLOGICAL SURVEY OF WISCONSIN;
DESCRIPTIONS OF
NEW SPECIES OF FOSSILS;

FROM
THE INVESTIGATIONS OF THE SURVEY;

To accompany the Report of Progress made to His Excellency, ALEXANDER W. RANDALL, on the 24th day of December, 1860.

BY JAMES HALL,
STATE GEOLOGIST AND PALÆONTOLOGIST.

OBSERVATIONS UPON THE GENUS *RECEPTACULITES*, DE FRANCE; with notices of some new species:

A characteristic fossil of the Lead bearing beds, was referred by Dr. D. D. Owen in his Report on the Mineral Region of the Northwest, in 1844, page 40, to *Coscinopora sulcata*, of Goldfuss, and he gives a figure of the same, pl. 7, fig. 5. It is subsequently cited in his reports, and in the catalogue of fossils accompanying the "Geology of Wisconsin, Iowa and Minnesota," (his last report upon that region,) the name is continued. This fossil however is clearly a *RECEPTACULITES*, and must be referred to that genus, I propose for it the name of *Receptaculites Oweni*.

In the report first mentioned (of 1844,) Dr. Owen figures on pl. 18, fig. 7, a fossil under the name of *Orbitolites, reticulata*. This name is not continued in the final list; but from similar specimens, I am constrained to refer this also to the genus *RECEPTACULITES*. In the report on the Geology of Wisconsin, Iowa and Minnesota, 1852, page 586, Dr. Owen describes, under Foraminifera, a new genus *SELENOIDES*, which he says he at first supposed would be found to belong to the genus *ORBITULINA*. The following is the generic description given page 586:

SELENOIDES (n. g.)

Generic character. "It was supposed at first that this singular fossil from limestones of Lower Silurian date of Iowa, would fall into the genus *ORBITULINA*. But as D'Orbigny regards this genus as an unequal-sided *Orbitolites*, in which one side is convex, incrustated, and showing numerous cells in oblique lines around the sides, it can hardly be grouped with it, as the Iowa fossil is umbilicated on one side, and the cellular, ring-shaped surface instead of being concave, is so convex as to form nearly a coiled cylinder. The other side being partly defaced in splitting it out of the rock, it is difficult to say whether it had a cellular surface similar to that shown of fig. 13, Tab. II. B., or concentric lines; what portion of it is visible rather indicates that the fossil was unequal-sided, not being umbilicated on the other surface; probably cellular, and not without concentric lines. There are no cup-shaped cells opening round the periphery, as in *ORBITOLITES*, which are said to be *equal-sided ORBITULINAS*."

"For the above reasons, I think it will constitute a new genus, peculiar to the Lower Palæozoic rocks. The horizontal section seems to present an internal arrangement of cells similar to those of *Orbitoides*."

Under this genus is described as follows, page 587 :

"*SELENOIDES IOWENSIS*, Pl. II B, fig. 13.

"*Specific Character*.—One side flatly dome shaped, the other ring shaped, enclosing an umbilicus or central depression. Small rhomboidal cells opening on the surface in curved rows, intersecting in arches; the cells gradually increasing in size from the inner margin to the periphery."

Having examined specimens of this fossil from the same locality as that figured by Dr. Owen, I am constrained to believe that this also is a species of *RECEPTACULITES* of different form from the prevailing one, and varying little if at all specifically from that figured under the name of *Orbitolites reticulata*, in 1844, before referred to.

In *Palæontology of New York*, 1847, Vol. I, p. —, I described a species of *RECEPTACULITES*, referring it with doubt to the *R. Neptuni* of De France. The specimen is solid, partly weathered on one side, and furnishes only unsatisfactory means of comparison and determination. More recently, Mr. Salter has studied a collection of specimens from Canada, which he regards as identical with the one figured by me, but differing from the European *R. Neptuni*, and proposes the name *R. occidentalis* for the Ameriman species.* In the volume referred to I also noticed and figured a fossil of discoid form with depressed centre; the weathered surface showing a reticulate texture; but the interior so entirely solid as to reveal no structure; and it could not be satisfactorily referred to any known genus at that time. Since knowing the western forms, I have become satisfied that this is generically and perhaps specifically identical with the fossil described by Dr. Owen as *Selenoides Iowensis*, which, when the surface is entire, has a similar reticulated structure. Its diameter is greater than any of the western specimens; but its condition does not admit of structural comparison.

In the study of the specimens collected in the lead region, I recognize four principal and prevailing forms of this genus; the most common and largest of which is the one originally referred to *Coscinopora sulcata*.

*Figures and descriptions of Canadian Organic Remains. Decade I, page 47-49, pl. 10.

GENUS RECEPTACULITES—DE FRANCE. (as emended.)

Generic Characters.—Body consisting of an infundibuliform spreading disc, more or less concave at the centre, depressed-orbicular, and globose. The spreading discoid forms consist of a range of vertical cells in single series; the orbicular discoid forms have radiated curving cells which are directed from the center or axis towards the margin, their length and curvature depending on the size and form of the mass; the foramina or cells in all the forms become larger as they recede from the centre to the periphery, and again become smaller, on the lower side, in the globose forms. Cells cylindrical, contracted below the aperture, and thickened or expanded above, with rhomboidal openings at each extremity. On one side the openings sometimes shows obsolescent rays; the interior walls of the cells are often striated as if preserving the remains of transverse septa.

In all these bodies the cells are arranged on curving lines which diverge from the center in a constantly enlarging circle; these are crossed by similar lines in an opposite direction, which thus leave quadrangular or rhomboidal spaces, "like the engine turned ornament of a watch." The form of these apertures depend upon the degree of curvature, or upon the form of the mass to which the curvature of the cell lines will conform. In all cases, however, the cell is cylindrical beneath the exterior.

Since the cells vary in size at different distances from the center, the size of the cells in separate fragments, affords no means, alone, for specific determination.

Regarding the form and mode of growth, I have recognized the following species in the Galena limestone of the lead region.

RECEPTACULITES OWENI—HALL.

Coscinopora sulcata, (Goldfuss.) Owen, loc. cit., page 40.

Description—Body consisting of a broad expanded disc, from four to twelve inches in width, and from one quarter to half an inch in thickness (rarely a little thicker). Surface undulating with an abrupt fannel shaped depression in the center of the upper side, from which the cell rows radiate in curved lines.

The thickness in the center is not more than one-eighth of an inch, and at a distance of three or four inches from the center is less than half an inch: cells cylindrical in the middle and contracted both above and below, the walls of the cavities, often showing transverse striae, which appear like the remains of septa. The distance of the cells from each other is variable, those near the center being closer together, though, in receding from the center, there are at intervals intercalated rows of cells, which take the same direction, and give the cells a closer arrangement towards the margin than in the intermediate space before the intercalation of the additional rows. The apertures both above and below are essentially rhomboidal; but in well preserved surfaces there are remains of rays, which, however, are rarely observed;* and I have not seen them on opposite sides of the same specimen.

The various stages of decomposition, and degrees of preservation, present a great variety of surface aspect. In some conditions, there is visible a distinct groove, extending along the surface from one cell to the next, across the curving interspaces. I have not observed in any of these specimens evidences of the connecting stolous shown by Mr. Salter, (loc. cit.)

Geological Formation and Locality.—In the Galena limestone of Wisconsin, Northern Illinois, and the eastern part of Iowa, this fossil is everywhere present, and is the most marked and characteristic form in the rock. It likewise occurs sometimes in positions where the Galena limestone is extremely thin, or not recognized as a distinct member of the group.

In the study of this species, which will be fully illustrated in the forthcoming report, I have been furnished with specimens by Messrs. I. A. Lapham, of Milwaukee, and J. H. Adams, of Lancaster; Prof. Nason, of Beloit, Wisconsin, and Mr. T. D. Robertson, of Rockford, Illinois.

RECEPTACULITES (*Selenoides*) IOWENE.

Selenoides Iowensis, Owen, Report on the Geology of Wisconsin, Iowa and Minnesota, p. 587, pl. 2, fig. 13.

Description.—Body discoid, convex below with a broad central attachment; upper side depressed in the centre, with an elevated and rounded border; cells arranged in radiating curved lines from the centre to the periphery, and which continue on the sides and lower surface; the cells are cylindrical

*This feature is very clearly set forth in a specimen from the collection of I. A. Lapham, Esq

within and contracted below the aperture. Surface reticulate in appearance, the cell openings communicating by a groove across the division, and between these are elevated interrupted, both ridges and grooves arranged in concentric lines crossing the cell divisions. The outline of the aperture or cell is rhomboidal, and in the centre of the bottom is a circular opening communicating with the cylindrical tube below.

When the surface is worn, it presents a series of round perforations, which are proportionally larger than they appear in unworn specimens simply from showing the diameter of the cell below the contraction. Transverse diameter three-fourths of an inch to two inches, and greatest vertical diameter rarely an inch. This species is far less common than *R. Oweni*.

Geological Formation and Locality.—It occurs in the Galena limestone, at Platteville, Wisconsin, Dubuque, Iowa, Galena and Rockford, Illinois.

RECEPTACULITES FUNGOSUM—HALL.

Description.—Body very broadly subturbinate or fungiform; rounded and very convex below, except the broad base of attachment; upper surface deeply concave in the center, convex towards the margin, and curving abruptly at the sides. Cells small, cylindrical, little contracted at the aperture, arranged in radiating curved lines from the center to the center to the periphery and continuing over the sides and base in the same direction. The central cells are vertical, but on approaching the periphery they are curved upwards and inwards; the lateral cells are directed horizontally and gradually turning downwards are again vertical, opening in the opposite direction from those of the center above.

Surface appearing reticulate from the concentric grooves which connect the cells upon the surface, and the parallel concentric ridges; while these are crossed below by the double series of diverging curved lines.

To conceive of the form of this species, one may fancy an expanded form of *R. Oweni* to be bent abruptly over at an inch or two from the center, and the margins drawn together below, forming a base of attachment.

The greatest diameter of this species, in the specimens examined, is about three inches; and the greatest elevation from the center of the base to the summit, is one and three-fourths to two inches; the depth of the central cavity below the plane of the summit being about half an inch. The length of the cells in the thickest lateral portions of the body, is about three-fourths of an inch.

This species is less common than either the *R. Oweni* or *R. Iowensis*. I have received, through Prof. Whitney from Capt. Beebe, of Galena, a very fine specimen for illustration, and others from Mr. Robertson, of Rockford, Illinois.

RECEPTACULITES GLOBULARE—HALL.

Description.—Body globose or sub-globose, with an irregular base of attachment; transverse diameter usually greater than the vertical diameter; summit a little depressed; cells arranged in radiating curved lines, the apertures rhomboidal and transversely elongated; the concentric groove and raised ridges between, strongly marked.

This species is readily distinguished by its small globose form, which is usually not more than three-fourths of an inch in diameter. It is more rare than either of the others, though I am informed by Prof. Daniels, that more than twenty specimens were obtained at a single locality in Wisconsin. About twenty years since, I received a specimen of this species from Mr. Thorp, of Mount Morris, Illinois, and have seen others in Galena, and in the collection of Prof. Daniels.

Geological Formation and Locality.—In the Galena limestone of the lead region of Wisconsin, Iowa and Illinois.

RECEPTACULITES INFUNDIBULUM—HALL.

Description.—Entire form of body unknown. The centre is a infundibuliform cavity, having a depth of one and a half inches with the same diameter of the summit; cells arranged in radiating curved lines; the lines of cell wall in one direction apparently curving very little, while the other seems to have a greater curve; cell apparatus quadrangular and nearly square within the central area, beyond this they are undetermined.

This species is described from some fragments in the limestone of Racine, from the collection of T. J. Hale. The geological horizon is that of the Niagara group, of New York.

RECEPTACULITES HEMISPHERICUM—HALL.

Description.—Body hemispheric, convex above, the centre not depressed. Cells arranged in radiating curved lines, which cross each other as in the other species of the genus. Cell apertures sharply defined, rhomboidal, opening by a round contracted orifice into the cylindrical tubes below.

The organic centre from which the cells radiate (in two specimens) is elevated, and does not quite correspond with the centre of the mass. The central cells are very minute, those near the margin having a diameter five or six times as great.

This species has nearly the same diameter as *R. iowensis*, but the cells are proportionally large, and the rhomboidal apertures more sharply defined, while the centre is not broadly depressed as in that one; but widely and sometimes almost hemispherically convex, with a slight depression on one side of the organic centre.

Geological formation and locality. In the limestone of Racine of the horizon of the Niagara limestone of New York.

Collector. T. J. Hale.

GRAPTOLITIDEÆ of the Lower Silurian rocks of Wisconsin.

GRAPTOLITHUS (*Diplograptus*) PEOSTA, HALL.

Description. Stipe (simple?) robust, rounded on the surface, with section broad-oval; very gradually widening from base, having a width of about eight hundredths of an inch: cellules narrow-elongate, about twenty-six in the space of an inch; length about three and a half times the width of the cell, the free portion being about one-third the length; inclined to the axis at an angle of about 35° ; extremities of the cells truncate, the apertures somewhat quadrangular and rounded on the sides. Cell partitions strong and well defined, reaching nearly to the centre of the stipe in its lower part, leaving a very narrow space for the common body, which becomes wider above. Surface transversely striated or wrinkled.

Geological formation and locality. In the shales of the Hudson River group in Wisconsin, Iowa and Illinois.

DICTYONEMA NEENAH, HALL.

Description. Frond spreading, infundibuliform, reticulate, the radiating branches slender, direct, a very little undulating, the transverse connecting filaments more slender than the branches; reticulations quadrangular or oval, the length from one and a half to twice the width; from six to seven and a half in the space of half an inch, and transversely from twelve to fourteen in the same distance. Serrations or cellules not determined.

This species is deeply funnel shaped, the branches but slightly diverging and the intercalated or implanted branches at distant intervals. The matrix is a compact granular limestone,

a substance unfavorable to the preservation of the cellules or of the finer markings of the surface.

In the form and proportions of the cellules and the greater proportional width of the connecting filaments, this species differs from any of those described.

Geological formation and locality. In the Trenton limestone of the Fox river, near Appleton, Wisconsin. I am indebted to Prof. R. Z. Mason, of the Appleton University, for the specimen.

Near the base of the Trenton limestone at Platteville and other localities, there are some slaty layers completely charged with fragments of organic bodies which have the appearance, color and texture of the Graptolitidæ. In 1860 I collected from this locality numerous specimens of these shales, and I am also indebted to Mr. J. D. Whitney (lately of the Wisconsin Survey, and now Geologist of California) for a piece of limestone from the same neighborhood, containing some of these forms in a more complete condition. Since that period, large numbers of specimens have been collected, showing an abundance of these fragments, quite unprecedented in any locality of Graptolites, which I have examined. Many of these fragments are long and slender, and have evidently been floated and macerated before being imbedded. Some of them are twisted together, either from their natural relations, or, what appears more probable, by the action of the waves before these forms were finally thrown down upon the muddy bottom. A few fragments of Trilobites and shells, with valves of *Lepiditina*, occur in the same association.

Notwithstanding this abundance of fragments, I have thus far been unable to make out more than a single form in a condition to be satisfactorily described. This form is generally distinct from any heretofore described, so far as I am aware. It consists of a long principal or central stipe, with diverging branches, closely arranged and often recurved. The stipes, so far as observed, are simple and linear, and the branches are simple and linear, terminating in a thickened lanceolate extremity. The main stipe is distinctly marked by round or oval spots, representing the cellules; the branches are striated, and with sometimes some obscure marks of cellules. For this form I propose the Generic name of *Buthograptus*.

GENUS BUTHOGRAPTUS, (nov. gen.)

Generic character. Frond consisting of a central stipe with closely arranged lateral branches, which are flexuous or re-

curved, (or perhaps sometimes rigid) proceeding rectangularly from the main stipe: which is celluliferous on one side (perhaps on both sides.) Branches plain and linear, celluliferous? Substance corneous brown or black in the shale and limestone.

The cellules on the central stipe are round or oval, and there are some obscure indications of cellules on the branches, but their determination is very unsatisfactory.

BUTHOGRAPTUS LAXUS, (n. s.)

Description. Frond slender, lax and flexuous, midrib or stipe linear, with oval spots marking the form and place of the cellules. Branches coming off at right angles to the stipe, slightly recurved in the middle, and sometimes bent abruptly backwards. Some obscure markings upon the surface of the branches may indicate the place of cellules: branches with lanceolate terminations. Surface striated.

Geological Formation and Locality. In dark-colored shaly limestone of the age of the Trenton limestone; at Platteville and vicinity, Wisconsin.

MELOCRINITES NODOSUS, (n. s.)

Description. Body pyriform, base truncate, gradually expanding to the top of the radial plates; dome rounded and more or less convex. Basal plates four, strongly nodose, extended laterally, and one half or more of the entire width occupied by the articulating facet of the column, which is deeply inserted. Radial plates three; the first largest and heptagonal; the second smaller and hexagonal; the third heptagonal. Interradial plates in series of one, two, and three: the first hexagonal and as large as the second radial; the second hexagonal and a little smaller than the third radials; the third smaller and somewhat irregular. The oval side is not usually distinguishable from the others, unless it be sometimes in a series of two larger plates above the second range in the interradian area. The dome consists of numerous small polygonal plates with a central or sub-central aperture or proboscis.

The third radial is a bifurcating plate, and upon the upper sloping sides rest brachial plates; of which there are two or three ranges below the free arms. Arms two from each ray, the structure unknown. The surface is marked by strong rounded tubercles, a single one on each plate, which, at its base, occupies the greater part of the area of the plate. These nodes are sometimes much elongated and smoothly rounded at

the summit (and rarely, a little contracted below). The dome plates are slightly nodose, often a little pointed, but in this respect variable.

This is a well marked species, and the specimens vary in height from less than half an inch, to an inch and three-eighths without important differences. When well preserved, the projecting arm-bases give a somewhat pentalobate aspect when viewed from the summit.

Geological Formation and Locality. In the drift about Milwaukee, supposed to be from rocks of Devonian age. I am indebted to Mr. I. A. Lapham for specimens from this locality. I have also received from Rev. W. H. Barris, of Burlington, Iowa, a specimen of the same species from Iowa City, and presumed to come from the rocks in that neighborhood, which are of Devonian age. *Specimens collected by Dr. P. R. Hoy, T. J. Hale and James Hall.*

GENUS EUCALYPTOCRINUS, GOLDFUSS.

EUCALYPTOCRINUS ORNATUS, (n. s.)

Description. Body below the arms sub-hemispherical, somewhat flattened at the base, with a narrow, deep, pentagonal basal cavity, formed entirely of the basal plates; which are long and gradually expanding towards their outer ends. First radial plates separated from the basal cavity by a deeply channelled suture, their width once and a half their height, and widest a little above the middle, upper margins concave. Second radials quadrangular, much wider than high; third radials hexagonal, larger than the second, widest near the base. First supra-radials but little smaller than the third radials. Second supra-radials much smaller than the first, pentagonal, supporting on each upper sloping side a small brachial plate upon which rest the arm plate. The first interradiial plate is the largest plate in the body, irregularly ten sided, height and width equal; supporting the second plates side by side on its upper edge. Intersupra-radial plates one in each series, proportionally small. Arms and interbrachial plates unknown.

Surface marked by moderately strong, irregularly radiating, interrupted lines with deep pits; sutures of plates rather widely channelled.

This species differs from *E. caelatus* (Pal. N. Y., vol. 2, pl. 47, fig. 4,) in the more nearly hemispherical cup, while the surface ornaments are lines more properly than granules, and

arranged in different forms, while the sutures are broad and deep channels instead of indistinct lines.

Geological Formation and Locality. In limestone of the age of the Niagara group, Racine, Wisconsin. *Dr. P. R. Hoy, T. J. Hale, James Hall.*

GENUS GLYPTOCRINUS, HALL.

GLYPTOCRINUS NOBILIS, (n. s.)

Description. Body large, robust, from base to the first bifurcation of the ray, sub-hemispherical; arm bases above this prominent, giving a strongly lobed form; dome highly elevated, the distance from the base of the free arms to the base of the proboscis being once and a-half as great as the distance below. Proboscis strong, sub-central, entire length unknown. Basal plates of moderate size, spreading almost horizontally from the column. First radial plates large, second radials hexagonal, much wider than high; third radials broadly pentangular, supporting on each upper sloping side a series of four supra-radials; the upper one of which is a bifurcating plate, and supports on the upper oblong sloping edges a series of arm plates; giving eight arms to each ray, so far as determined.

First interradiial plate large, six or seven sided, with two smaller plates in the second range, three in the third, and several small polygonal plates above filling the interbrachial spaces, and connecting with the dome plates. Anal series unknown. Dome composed, near the base, of small polygonal plates, gradually increasing in size towards the proboscis; the dome is strongly lobed, and the depressions correspond with the interbrachial spaces. Surface of calyx plates marked by a single set of strong radiating ridges, which connect at the sutures with those of the adjoining plates; the interspaces occupied by one or more small round nodes, which are sometimes confluent. The ridge along the radial series is much the strongest, and forms a node on the centre of each plate. The dome plates are marked by similar, but less distinct lines, and a small round node on the center of each plate.

This species differs from *G. decadactylus* (Pal. N. Y. Vol. 2) in the larger size; the shortness of the base; the very large dome, and strong proboscis; as well as in the surface marking and greater number of arms.

Geological formation and locality. In limestone of the age of the Niagara Group, Racine, Wisconsin. *Dr. P. R. Hoy, James Hall.*

GLYPTOCRINUS SIPHONATUS, (n. s.)

Description. Body large, broadly obovate, the greatest width being above the origin of the arms; calyx narrow below, spreading gradually to the bases of the arms; dome inflated on the anterior(?) side. Arms rising from the body in pairs with deep constrictions between; arrangement and forms of plates of calyx not fully determined; those of the dome are small and polygonal.

The above description is drawn from internal casts. This species differs from *G. nobilis* in the much greater length of calyx which is not contracted in the lower part; while in that species it is broad and spreading. It appears not to have had a proboscis; but in the casts there is the filling of a cavity which has passed from the summit of the dome between the postero-lateral arms, where it turns outwardly, as if it had opened on the exterior surface in the form of an oval opening.

Geological Formation and Locality. In rock of the age of the Niagara group; Racine, Wisconsin. *Dr. P. R. Hoy, T. J. Hale, James Hall.*

GENUS BALANOCRINUS, Troost.

BALANOCRINUS INFLATUS, (n. s.)

Description. Body below the arms subturbinate, with sides somewhat inflated in the lower part; arm bases prominent, leaving deep interbrachial spaces; dome low, strongly inflated on the oval side, surmounted by a slender sub-central proboscis. Basal plates small, pentagonal. Sub-radial plates proportionally large, hexagonal. First radials heptagonal, a little larger than the sub-radials; the form of the second and third radials undetermined; the second are as large as the sub-radials; the third very small.

Interradial plates, six; the first hexagonal, as large as the second radials, with two in the second range, and three in the third range, uniting with the dome plates. Anal plates numerous, form and arrangement unknown.

The above descriptions have been drawn from the internal casts of several specimens, which exhibit the divisions of the plates.

This species differs from *B. sculptus*, Troost; *Lampterocrinus tennesseensis*, Roemer "Silurian Fauna of Western Tennessee," in being more distinctly turbinate or obconical; in the deeper interbrachial spaces; and the inflation of the dome on the anal side.

Geological Formation and Locality. In limestone of the age of the Niagara Group, Racine, Wisconsin. *Dr. P. R. Hoy, T. J. Hale, James Hall.*

GENUS CARYOCYSTITES, VON BUCH.

CARYOCYSTITES CYLINDRICUM, (n. s.)

Description. Body elongate-obovate, or sub-cylindrical; rounded at top and abruptly contracted at base near the junction with the column; basal plates undetermined. The first range above the basal series consists of eight elongate hexagonal plates, their length once and a half the greatest width, gradually expanding in width from below upwards. These are succeeded by a second, third, fourth and fifth range of eight plates in each, all somewhat regularly hexagonal, their length a little greater than the width. Of these, the fourth range is usually the widest, situated at a little more than one third the length of the body from the summit, and at the point of greatest diameter. The sixth range above the basal plates are much smaller than the others, and narrowest at their upper ends. Alternating with the last there is a seventh range of smaller plates, surrounding those of the summit and enclosing the summit openings. Column small, round, rapidly tapering below the point of attachment. Surface characters unknown.

The above description is drawn from specimens which are casts. The divisions of the smaller plates are seen, and one of the apertures of the summit is well marked on several individuals; but the ovarian aperture (which is described as being on the side towards the lower part of the body in CARYOCYSTITES,) has not been satisfactorily determined. The surface appears to have been coarsely granulose.

Geological Formation and Locality. In limestone of the age of the Niagara group at Racine, Wisconsin. *Dr. P. R. Hoy, James Hall. Grafton, Wis., Edward Daniels.*

CARYOCYSTITES ALTERNATUM, (n. s.)

Description. Body extremely elongate, sub-cylindrical, the greatest diameter near the apex, extremity with irregular constrictions near the middle in some specimens. Summit irregularly rounded, flattened, or depressed on the side of the aperture; base gradually tapering to the summit of the column. The body is composed of several (twelve) ranges of plates, varying in size and shape; in some of the ranges they are large, mostly octagonal, eight in number, in a range;

in others they are much smaller, pentagonal or hexagonal, and about twice as many as in the ranges of larger plates; these ranges alternate with each other. Near the summit, between what appears to be the eleventh and twelfth ranges of plates from the base, there is a distinct lateral opening, with another somewhat smaller opening more nearly on the summit, corresponding with the mouth and anal opening as described by Von Buch; but the lower lateral aperture (ovarian aperture) has not been recognized; most of the specimens being broken near the base, and weathered on one side. Surface characters unknown.

The specimen, like those of the last species, are casts, but the characters given above are distinctly seen in several individuals. The structure of the body does not very well correspond with the generic characters of *Caryocystites*, and it may be necessary, when more perfect specimens are discovered, to designate it by another name.

Geological formation and locality. In limestone of the age of the Niagara Group.

Collector. T. J. Hale.

BRACHIOPODA.

LINGULA POLITA, (n. s.)

Description. Shell small, short ovate, the greatest width near the front, which is broadly rounded; beaks obtusely rounded; valves moderately convex, with prominent umbones. Surface glabrous, or marked by very fine concentric lines of growth.

The interior of the ventral valve shows a distinct spatulate muscular impression in the centre, with raised margins, and fainter impressions at the sides. There is an obtuse dental process on each side of the rostral cavity.

This species differs from *L. prima* in the prominence of the of the umbones, and in being destitute of lamellose concentric lines of growth. The shell was referred by Dr. D. D. Owen to *OBOLUS*, but I am unable to find satisfactory evidences of the features of *Obolus*; neither do the characters correspond with true *Lingula*.

Geological formation and locality. In Potsdam sandstone, in beds below those containing *Conocephalus* and *Arionellus*, at Trempeleau, Wisconsin. *Edward Daniels, James Hall.*

LINGULA AURORA, (n. s.)

Description. Shell of moderate size, broadly subovate; beak appressed, obtusely pointed; cardinal borders strongly diverging,

inclosing an angle of about 80° , and extending a little more than one-third the length of the shell; sides sub-parallel for a short distance; front rounded; valves very slightly convex. Surface marked by rather strong concentric lines of growth, and a few striæ on partially exfoliated specimens.

This species varies from the last in being five or six times as large, measuring nearly three-fourths of an inch in length by a little more than half an inch in width. The form is distinct from every other species described from rocks of the same age.

Geological Formation and Locality. In rocks of the age of the Potsdam sandstone, Trempeleau, Wisconsin. *James Hall.*

SPIRIFER GIBBOSUS, (n. s.)

Description. Shell somewhat below the medium size, gibbous, beaks slightly incurved, area less than the width of the shell below; about three times as wide as high; cardinal extremities rounded; foramen large, higher than wide; valves marked by about four simple rounded plications on each side of the mesial elevation. Dorsal valve extremely gibbous on the umbo, regularly arcuate transversely; mesial elevation broad, flattened on top; plications not extending to the beak, which is a little incurved. Ventral valve deeper than the dorsal, but less arcuate; mesial depression broad and deep, rounded at bottom. Surface of both valves (in well preserved specimens) show evidence of fine radiating striæ.

This species resembles *S. crispus* of the Niagara group in New York, but is much larger, frequently more than twice as wide as that species; the mesial elevation is wider and not so high. The specimens described are all internal casts, so that the external surface characters cannot be fully given.

Geological Formation and Locality. In limestone of the age of the Niagara group, Racine, Wisconsin. *Dr. P. R. Hoy, T. J. Hale, James Hall.*

SPIRIFER EUDORA, (n. s.)

Description. Shell of moderate size, transversely sub-ovate, length and width as three to four, valves extremely gibbous; hinge line less than the width of the shell below; cardinal extremities rounded; area moderately high; foramen triangular, a little higher than wide. Valves marked by three to four simple, strong, angular plications on each side of the mesial fold and sinus. Dorsal valve regularly arcuate; beak somewhat incurved; mesial fold of moderate width, flattened above and slightly depressed in the lower part. Ventral valve most prominent near the umbo; back strongly incurved over the area;

mesial sinus broad and deep. The minute surface characters are unknown. The specimens are casts.

This species bears some resemblance to *S. macropleura* of the Lower Helderberg group, of New York; but it is proportionally more gibbous, the front more regularly rounded, the area higher, and the plications not directed so obliquely outwards from the beak.

Geological Formation and Locality. In limestone of the age of the Niagara group, Racine, Wisconsin. *T. J. Hale.*

SPIRIFER INCONSTANS, (n. s.)

Description. Shell transversely elliptical, the length a little more than half as great as the width; hinge line two-thirds as long as the greatest width of the shell; cardinal extremities rounded; both valves moderately convex, marked by strong, angular, dichotomizing plications. Dorsal valve most prominent on the umbones; mesial fold broad and simple on some specimens, and on others divided into two, three, or more plications in front; beak produced and moderately incurved. Ventral valve larger than the dorsal; beak prominent, but little incurved; area high; deltidium large, height and width nearly equal; sinus broad and deep, simple or with two or more plications. Entire surface marked by strong, distinct, radiating striae. The specimens are casts of the interior and exterior.

This species may be readily distinguished from others by the strong, angular, bifurcating plications, the number of which vary in different individuals; some being nearly simple, having but four or five on each side of the mesial fold, while others have nearly double that number on the front margin. The number of plications on the mesial fold and sinus are subject to the same variation.

Geological Formation and Locality. In limestone of the age of the Niagara group, Racine, Wisconsin. *Dr. Hoy, T. J. Hale, James Hall.*

TELLINOMYA INFLATA, (n. s.)

Description. Shell of medium size, extremely gibbous, and inflated at the middle of the sides, abruptly attenuate towards the posterior end; the length a little greater than the breadth, and the thickness a little less; the hinge line, from a little anterior to the beak to the posterior end of the shell, is nearly straight, the anterior end obliquely truncate above the middle; the basal margin strongly and regularly rounded from the ante-

rior truncation to the posterior extremity of the hinge line—the meeting of the curved lower and straight upper margin giving a sub-nasute extremity. Umbones prominent, very full and rounded, the beaks closely incurved, the apices minute. Surface marked by concentric ridges, of growth parallel to the margin of the shell.

This species has some resemblance to *T. ventricosa*, in its form and general outline; but it is much broader in proportion to the length, less attenuate posteriorly, the beaks are nearest to the anterior, and the basal margin is destitute of the sinus which exists in that species,

Length nearly seventh-eighths of an inch, height three-fourths of an inch.

Geological Formation and Locality. In limestone of the age of the Trenton limestone; at Mineral Point, Wisconsin.

TELLINOMYA ALTA, (n. s.)

Description. Shell small, sub-triangular, with rounded basal margin; valves depressed-convex. The anterior and posterior portions of the hinge line are nearly straight from between the beaks to beyond the muscular impression, and stand nearly at right angles to each other. The distance from the beaks to the base of the shell is usually equal or nearly equal to the length.

The muscular impressions are large and moderately distinct; the posterior one elevated on the dorsal side with a broad, low ridge (depression on the cast) passing from near the beak to the scar. The hinge plate is marked by from twenty to twenty-five very small curved teeth on the posterior side, and from ten to fifteen on the anterior side.

This species differs from *T. astartæformis*, (*Ctenodonta*† *astartæformis*, Salter, Canadian Organic Remains, Decade I, page 27,) in the more erect beaks and in the different form of the posterior basal margin.

Geological Formation and Locality. In limestone of the age of the Trenton limestone; Dodgeville, Wisconsin. *T. J. Hale.*

TELLINOMYA VENTRICOSA, (n. s.)

Description. Shell sub-rhomboidal, extremely ventricose, with strong incurved beaks, the anterior dorsal and ventral margins sub-parallel, the posterior and obliquely truncate, the anterior end broadly rounded, and continuing into the basal margin; posterior umbonal slope somewhat angular, with a slight sulcus just anterior to it, which passes from near the beak of the base. Surface marked by obscure concentric striae of growth.

The interior is marked by large, double, profoundly deep muscular impressions; the principal scars are abruptly depressed on the inner margins, the minor scars faintly marked except on old individuals. The hinge plates are of medium width and contain about eight or ten slightly curved teeth on the anterior side of the beak, and from twelve to fourteen on the posterior side; beaks (in the cast) rather distant. The internal cavity of the shell is deep.

This species somewhat resembles *T. contracta* (*Ctenodonta contracta*, Salter, Canadian Organic Remains, Decade I, pl. 8, fig. 4 and 5); but differs in the greater proportional length, greater breadth of the anterior end, and greater obliquity of the posterior slope. The shell is more ventricose, the beaks nearest to the posterior end (instead of the anterior) and the muscular impressions more deeply marked.

Geological Formation and Locality. In rocks of the age of the Trenton limestone group; the buff limestone, at Beloit, Janesville and Mineral Point, Wisconsin; at Dubuque, Iowa, the Falls of St. Anthony, and other places.

Collectors. Prof. Nason, E. Hobart and James Hall.

TELLINOMYA OVATA, (n. s.)

Description. Shell ventricose, sub-ovate; cardinal line straight or very little curved; anterior and broad, obliquely truncate; posterior end short, narrow; basal margin broad rounded, a line drawn from its junction with the anterior and posterior slopes passes across the middle of the shell; beaks small, not prominent, curved, directed towards the anterior end. Valves gibbous at the anterior and attenuate at the posterior end; the length, breadth and thickness of the valves when compared are seven, six and five. Surface of shell smooth or marked by a few concentric lines of growth of moderate strength.

This species resembles *T. nasuta*; but the beaks are more nearly central, and the posterior end is not produced in the same manner. The basal line is regularly curved and does not show the contraction on the posterior side of the middle of the base which is observed in that species.

Geological Formation and Locality. In the Trenton group, (Buff limestone,) Beloit, Wisconsin.

Collector. Edward Daniels.

GENUS CYPRICARDITES, CONRAD; CYRTODON AND
VANUXEMIA, BILLINGS; PALÆARCA, HALL

CYPRICARDITES ROTUNDATA. (n. s.)

Description. Shell sub-globose, hight and width nearly equal and thickness about four-fifths as great as the hight from beak to base; beaks slightly incurved, cardinal line curved, front rounded, surface smooth or marked by obscure concentric lines of growth. The interior of the hinge plates marked by two lateral teeth and about four oblique cardinal teeth, Anterior muscular impression of moderate size, distinct; posterior impression obscure, pallial impression very distinct on the anterior end.

Length three-fourths to one inch; greatest hight a little more than the length.

Geological Formation and Locality. Trenton group, (Buff limestone), Beloit, Wisconsin.

Prof. Nason, Mr. E. Hobart, T. J. Hale, James Hall.

CYPRICARDITES NIOTA. (n. s.)

Description. Shell broadly sub-ovate, broadest at the posterior end; umbones very gibbous; beaks incurved, little elevated, situated about one-fourth of the length of the shell from the anterior end. Cardinal line straight or little curved; anterior, posterior and basal margins rounded.

Anterior muscular impression situated near to the cardinal line, well defined; posterior imprint obscure. Surface of the shell marked by concentric lines of growth.

This species differs from *C. rotundata* in being more oblique, in the straighter cardinal line, and less ventricose form. It is intermediate between that species and *C. ventricosa*, from which it differs in the less obliquity and the greater length from beak to base.

Length one inch and a quarter, hight one inch.

Geological Formation and Locality. In Trenton limestone, (Buff limestone), Beloit and Chaupierre, Wisconsin.

Prof. Nason, Mr. Hobart, T. J. Hale, Jas. Hall.

CYPRICARDITES RECTIROSTRA, (n. s.)

Description. Shell somewhat elongate-ovate, gibbous in old specimens, young individuals moderately convex; beaks elevated, distant, scarcely incurved; hinge line but little curved; anterior end short, posterior end forming the greatest length of the shell; basal margin margin making nearly a semicircular curve. In-

terior (as shown in casts,) with strongly marked muscular imprints; the anterior one having its cardinal margin excavated out of the hinge plate, not deeply seated, somewhat reniform; the posterior imprint situated at near half its diameter below, extremities of the lateral teeth irregularly oval; pallial impressions usually distinctly marked, sometimes bounded by an elevated ridge, in casts, showing a depression in the shell. Lateral teeth situated obliquely to the hinge line, four in number, cardinal teeth several, the precise number not determined. cavity of the beaks deep. External surface of shell unknown. Length from one and a quarter inches to two inches, height from summit of beaks to base greater than the length.

This species differs conspicuously from all others except *P. rotundata* in the highly elevated and nearly straight beaks; and from that species in the proportionally greater distance from the beaks to the base of the shell, and the less rounded outline. The beaks of that species are much more curved than in this.

Geological Formation and Locality. Trenton limestone group, (Buff limestone); at Janesville, Wisconsin, and near Dubuque, Iowa.

Collectors Dr. Thomas Scott, T. J. Hale, James Hall.

GENUS MODIOLOPSIS, HALL.

MODIOLOPSIS PLANUS, (n. s.)

Description. Shell, small compressed, the length a little greater than the breadth, wider posteriorly. Cardinal line straight from the beaks to the posterior end, having a sub-alate appearance; somewhat narrowly rounded anteriorly, the basal margin straight, or but little curved, except at the anterior end. Posterior end obliquely truncate. Beaks small, but little or not at all incurved; umbonal slope moderately prominent, and sub-angular. In the casts, the anterior muscular impression is distinctly double, and well marked, the upper one situated close to the cardinal border; the posterior impression is larger and double, but less distinct, situated about two-thirds the distance from the beaks to the posterior margin; pallial line entire and somewhat distinctly marked.

Surface marked by strong concentric lines of growth. Length about three-fourths of an inch.

This species resembles the *M. subspatulatus* more than any other species known to me, but is much more oblique, has a proportionally longer hinge line, is more alate, and the umbonal slope continues to the junction of the basal and posterior

margins. The truncation of the posterior end is a feature which will at once distinguish it from that species.

Geological Formation and Locality. In the Trenton limestone group (Buff limestone); at Beloit, Wisconsin.

MODIOLOPSIS? SUPERBUS, (n. s.)

Description. Shell large elongate, sub-elliptical in outline; cardinal line very slightly curving throughout its entire length, and reaching no more than half the distance from the beaks to the posterior extremity of the shell. The posterior margin from its junction with the hinge line, is but little curved till near the extremity of the shell, where it is abruptly rounded to the base line, which is gently arcuate throughout its entire length except a slight sinuosity caused by a gentle depression extending obliquely from the anterior side of the beaks to the basal margin a little behind the beaks, anterior and narrow and abruptly rounded. Beaks moderately elevated, gently incurved and approximate, situated about one-sixth of the entire length of the shell from the anterior end; a strong rounded or sub-angular umbonal ridge extends from the beaks to the postero-basal extremity of the shell, becoming more gently rounded as it recedes from the beaks.

Surface marked by strong concentric undulations, parallel to the lines of growth.

This is a large and fine species, equalling the *M. modiolaris* in size, but possessing some peculiarities which makes the propriety of its reference to the genus doubtful.

Geological Formation and Locality. In limestone of the age of the Trenton limestone (Buff limestone), Beloit, Wisconsin.

GENUS AMBONYCHIA, HALL.

AMBONYCHIA CANCELLOSA, (n. s.)

Description. Shell obliquely sub-ovate in outline, with ventricose valves, becoming compressed and attenuate towards the extremity of the hinge line. Beaks slender, pointed and directed forwards. Hinge line straight, a little less than the greatest width of the shell. Anterior margin rather deeply impressed in the upper part, and in some specimens showing a shallow sinus, making what appears to have been a byssal opening, the lower part is regularly rounded into the basal margin. The posterior end is somewhat squarely truncate from the extremity of the hinge line and gradually curving below.

Surface marked by numerous strong concentric flattened

lamellose ridges, without visible radiating striæ in the partially exfoliated shell.

On casts, the large muscular impression is of a circular form, and is situated on the posterior side of the shell at about half its diameter below the hinge line, leaving a distinct depression reaching nearly to the beak, from its advancing with the growth of the shell.

This species is easily distinguished from any other known to me, by its form and lamellose surface, which is not strongly ridged as in the *A. undata* of the Trenton limestone in New York.

Geological Formation and Locality. In the Trenton limestone group at Mineral Point, and opposite to Dubuque, in Wisconsin.

Collector. T. J. Hale, James Hall.

AMBONYCHIA PLANISTRIATA, (n. s.)

Description. Shell obliquely sub-ovate, with moderately convex valves, most convex a little anterior to the centre; the anterior side full and rounded, less ventricose posteriorly. Hinge line straight, less than the greatest width of the shell. Anterior and posterior margins broadly rounded. Beaks strong, projecting above the hinge and slightly incurved.

Surface marked by distant concentric undulations, and by moderately fine radiating striæ, which are flattened and have very narrow interspaces.

This species differs from the preceding in the less obliquity of the valves in the shorter hinge line and in the radiating striæ. It is more nearly related to *A. orbicularis*, of the New York rocks, but is a little more oblique, less extended anteriorly, not so ventricose, and the radiating striæ are stronger.

Geological Formation and Locality. In limestone of the age of the Trenton limestone of New York, at Mineral Point and Beloit, Wisconsin.

Collector. Prof. Daniels, T. J. Hale.

AMBONYCHIA ERECTA, (n. s.)

Description. Shell sub-quadrangular in outline with convex valves, hinge line straight, as long as the greatest width of the shell, forming a little less than a right angle with the anterior border. Posterior slope nearly parallel with the anterior. Basil margin strongly rounded. Beaks in the casts, small, abruptly attenuate, projecting little above the hinge line.

Surface (as indicated in casts,) marked by concentric undulations only.

This species differs from the preceding in the more quadrangular form and erect position of the beaks.

Geological Formation and Locality. In rocks of the age of the Trenton limestone of New York, at Beloit, Wisconsin.

AMBONYCHIA ATTENUATA, (n. s.)

Description. Shell elongate-ovate, widest below the middle; width a little more than two-thirds the length; attenuate at the beaks; ventricose in the middle, regularly arcuate from the beak to the base; hinge line straight, a little more than one-third as long as the greatest length of the shell, and very oblique to the axis. Beaks elevated and directed forward, obtusely pointed and incurved at their extremity. Surface character unknown, except a few undefined concentric undulations upon the casts.

This species, in form, is somewhat like *A. bellastriata* of the Trenton limestone in New York; but the shell is proportionately more elongated, the anterior side straighter and the umbones and beaks less curved forward.

Geological Formation and Locality. In the Buff limestone, age of Trenton limestone of New York, at Beloit, Wisconsin.

Collector. T. J. Hale.

GASTEROPODA.

GENUS PLEUROTOMARIA, DE FRANC.

PLEUROTOMARIA NIOTA, (n. s.)

Description. Shell large, broadly sub-conical, the diameter through the last volution equal to about four-fifths of the height, consisting of six volutions, which are flattened on the periphery, with a very slightly concave space upon the upper side, extending to the suture; lower side rounded into the moderately large umbilicus. the last volution large and ventricose.

Surface character unknown, except a few undefined undulations near the extremity of the last volution, which are more distinct below than above.

This species is intermediate in form, between *P. subconica* and *P. bicincta*; resembles the first very closely in general outline, except that the volutions are a little too convex above the centre, and the flattening of the periphery is much greater than the narrow carina of the species; and in casts there

is a more distinct suture line. From the latter it differs in its much greater size, in its greater breadth in proportion to its elevation, and in the volution being less angular above the centre, and in having a wide flattened space on the periphery, instead of the narrow carina of that species.

Geological Formation and Locality. In the Buff limestone, of the age of the Trenton limestone group of New York.

PLEUROTOMARIA NASONI, (n. s.)

Description. Shell very depressed conical, the elevation of the spire being little more than half as great as the breadth across the base, consisting of four or five volutions, which increase very gradually from the apex. The upper side of the inner volutions somewhat rounded, becoming more flattened in the outer ones, with a distinct depression near the outer angle which in some specimens extends a little more than half way from the edge of the suture. Under side obtusely rounded into the umbilicus, which (in casts) is large and shows about one-third the width of each of the preceding volutions.

Surface characters unknown.

This species is somewhat related to *P. lenticularis* of the Trenton limestone of New York, but the spire is much more elevated, the volutions more distinct and more elevated one above the other, and the lower side is more ventricose, giving a wider periphery.

Geological Formation and Locality. In the "Buff limestone" of the age of the Trenton limestone of New York, at Beloit, Wisconsin.

Collectors. Prof. Nason, and Mr. Hobart of Beloit, and James Hall.

PLEUROTOMARIA HALEI, (n. s.)

Description. Shell depressed, orbicular, the spire moderately ascending, the height equal to a little more than two-thirds the greatest diameter, consisting of three or four volutions, which are somewhat rounded on the top, and expanding somewhat rapidly in size, the last one quite ventricose, and in the cast is sub-angular on the periphery. The under side of the last volution is rounded from the edge into the rather large umbilicus.

The surface, as preserved in a mould of the exterior in the stone, is marked on the upper side of the volution by ten or

twelve moderately strong revolving ridges, which are smaller and more closely arranged towards the suture (where there is a slightly depressed or flattened space.) These are crossed by numerous less strong, closely arranged transverse striæ, which bend backwards from the suture and have a strong retial curve on the narrow concave band of the periphery.

Surface characters of the under side undetermined.

This species is so entirely distinct in its form and surface characters from any other species yet known in our Silurian rocks, that it can be readily distinguished. It is more nearly allied with forms in the upper Helderberg and Hamilton groups of New York.

Geological Formation and Locality. In limestone of the age of the Niagara group of New York, at Racine, Wisconsin.

Collector. T. J. Hale.

PLEUROTOMARIA IDIA, (n. s.)

Description. Shell depressed orbicular, moderately convex above, and broadly umbilicate beneath, with about four volutions, which are moderately convex above and gradually increase in size from the apex, the outer half of the last one being more ventricose and regularly rounded on the periphery, and into the broad umbilicus; aperture or section of volution near it broadly ovate.

Surface characters unknown.

This species differs from the last in being less elevated, in its more gradually increasing volutions, broader umbilicus and absence of angularity on the periphery.

Geological Formation and Locality. In limestone, of the age of the Niagara group, at Racine, Wisconsin.

Collector. T. J. Hale.

PLEUROTOMARIA HOYI, (n. s.)

Description: Shell broadly sub-conical, the spire moderately elevated, consisting of about four volutions, which are gradually enlarged from the apex, the last one becoming somewhat ventricose towards the aperture. Volutions flattened upon the upper side, and the entire height of each one showing above the other; periphery somewhat flattened with a depressed band truncating the upper angle. Lower side of volution flattened, except the outer half of the last one, which is rounded towards the aperture, and abruptly descending into the moderately wide umbilicus.

Surface finely striated on the lower side of the volution, with a deep retral curve on the band, where the striæ are somewhat fasciculate.

This species resembles *P. umbilicata* of the Trenton limestone, but the volutions are more elevated above each other, and the upper surface is wide and flat.

Geological Formation and Locality. In limestone of the Niagara group, at Racine, Wisconsin.

Collector. T. J. Hale.

PLEUROTOMARIA SEMELE, (n. s.)

Description. Shell sub-conical; spire ascending; height and breadth nearly equal, consisting of four or five rounded or sub-angular volutions, the last one ventricose, sub-angular on the periphery, regularly rounded below with the small umbilicus. Aperture round.

Surface marked by a sub-angular carina a little below the suture, and on the periphery by a moderately broad revolving band, sharply elevated at the margins and concave in the middle. Entire surface marked by sharp, elevated, closely arranged, concentric striæ, which are curved abruptly backwards from the suture to the revolving band, on which they make a shallow retral curve, and below the band, have a gentle forward curvature in passing downward to the umbilicus. Height a little more than one inch; width three-fourths of an inch.

This species differs from any other known in rocks of the lower Silurian rocks, in the form of the volutions and surface markings.

It may be that this is a MURCHISONIA, the elevation of the spire being greater than the width of the shell; but the aperture is too imperfect to determine it.

Geological Formation and Locality. In the shales above the Galena limestone, at Makoqueta creek.

GENUS MURCHISONIA, PHILLIPS.

MURCHISONIA LAPHAM, (n. s.)

Description. Shell turritiform, robust; volutions seven or eight, gradually increasing from the apex, rather ventricose on the exterior, with close sutures; the upper half of the volution very slightly flattened, giving a scarcely perceptible angularity in the region of the revolving band. Section of volution broadly ovate; the breadth equal to four-fifths of the height, and the greatest diameter on the lower third.

Surface marked near the middle of the volution by a somewhat broad band, the margins of which are prominent; the upper part of the volutions are marked by fine transverse striæ, which are directed gently backwards from the suture to the revolving band.

This species very closely resembles specimens of the *M. Logani* of the Galt limestone of Canada West, but the volutions of that species are more ventricose, and the spire more rapidly ascending.

Geological Formation and Locality. In limestone of the age of the Niagara group, at Racine, Wisconsin.

Collector. T. J. Hale.

Dedicated to Mr. I. A. Lapham, of Milwaukee.

GENUS MACLUREA, LESEUEUR.

MACLUREA BIGSBYI, (n. s.)

Description. Shell thin, of medium size, discoid, consisting of about four volutions, with the umbilical (flat) side very slightly depressed in the middle, and having the outer margin of each volution slightly elevated above the inner or umbilical margin, which, although attached to the preceding one a little below the angle, gives a depression to the centre of the plane by reason of the greater breadth of the outer volution. Upper side very convex, giving an almost hemispherical outline to this side, with a rather broad umbilical cavity, the upper margins of which are rounded.

Surface marked on the periphery by strong revolving striæ, and on the convex side by strong, closely arranged and but little elevated striæ. Diameter one to two inches.

This species differs from the *M. magna*, of the Chazy limestone, in its greater depth and the more ventricose volutions. From *M. Logani*, of Salter Canadian Organic Remains, Dec. I, vol. 1, it differs in the less rapidly increasing volutions.

Geological Formation and Locality. In limestone of the Trenton limestone group, (Buff limestone), at Mineral Point, Fulton and Janesville, Wisconsin.

Collector. T. J. Hale, James Hall.

GENUS ECCULIOMPHALUS, PORTLOCK.

ECCULIOMPHALUS UNDULATUS, (n. s.)

Description. Shell consisting of one or two volutions, spirally coiled, but distantly separated from each other, rapidly increasing in size from the apex, and of a sub-triangular or

ovato-triangular form, the upper side being convex and curving to the ventral margin; the dorsum is somewhat flattened, and the lower side sloping with a gentle curve from the lower lateral angle to the ventral side, which is narrow and sharply rounded. Along the ventral side and a little below the centre there is a narrow, abruptly depressed groove, which extends the entire length of the shell.

Surface of the shell marked by obscure undulations, which are most distinct on the lower lateral angle, also on the lower side by two or three revolving ridges. Fine transverse lines of growth parallel to the margin of the aperture, are visible over the greater part of the surface of the specimen, which is essentially a cast of the interior.

Geological Formation and Locality. In the Buff limestone of the Trenton limestone group, at Beloit, Wisconsin.

CEPHALOPODA.

GENUS LITUITES, BREYN.

LITUITES UNDATUS, VON OCCIDENTALIS, (n. s.)

In the "Buff limestone," of Wisconsin, there occurs a large *Lituites*, which has usually been referred to the *Lituites undatas* of the Black River limestone of New York. On comparing specimens of the two together, I find several important differences, which could scarcely be expected to happen in so well marked a species as the *L. undata*, as it occurs in the New York rocks. In specimens of about the same size, the volutions of the Western one are much wider in proportion from the ventral to the dorsal side, they are more flattened on the sides and the back is squarely truncated; the New York specimens being rounded on the sides and moderately flattened on the back. The volutions in the latter have apparently a greater proportional lateral diameter, and the septa are more distant.

In consideration of these differences, I have proposed to indicate it as a distinct variety, which hereafter may prove to be specifically distinct.

Geological Formation and Locality. In the lower part of the "Buff limestone," at Beloit and elsewhere, in Wisconsin.

LITUITES ROBERTSONI, (n. s.)

Description. Shell discoid, consisting of three or four volutions. Volutions ventricose, very slightly embracing, rounded on the sides and somewhat flattened on the middle of the

back, the ventral sides being slightly concave, giving a very obtusely quadrangular section to the volution, the lateral diameter of which is a little greater than the dorso-ventral diameter.

Septa concave, numerous, these being on the back, about six in the space equal to the lateral diameter at the same point. Siphuncle small, situated on the back of the volution, outer chamber very gradually expanding.

Surface marked by obscure undulating folds, which commence upon the vertical side of the volution, and arching backwards unite with those from the opposite side in low ridges which are bent backwards in a broad sinus upon the dorsum. Lines of growth parallel to the undulations cover the entire surface.

This species differs conspicuously from *L. undatus* of the Trenton limestone of New York in the much more closely arranged septa, those of that species being less than half the number in the same space where the diameter of the volution is the same.

Geological Formation and Locality. In the "Buff limestone" of the Trenton limestone group, at Beloit, Wisconsin, and Rockford Illinois.

The species is dedicated to T. D. Robertson, Esq., of Rockford.

GENUS CYRTOCERAS, GOLDFUSS.

CYRTOCERAS WHITNEYI, (n. s.)

Description. Shell robust, elongate arcuate, somewhat rapidly tapering, laterally compressed, giving an elliptical section, the lateral diameter being equal to three-fourths the ventral diameter, outer chamber short, septa numerous, but little concave, and exteriorly are directed forward on the dorsum, more closely arranged towards the apex and generally becoming more distant as the shell expands towards the aperture. On one specimen at a point where the dorso-ventral diameter measures three-fourths of an inch there are twelve septa in the length of one inch on the dorsum, while in the outer part where the diameter is less than one inch and one-fourth, there are but six septa in the length of one inch.

The surface of the shell is exfoliated, but there are distinct traces of longitudinal ridges which are situated at about three times their diameter from each other. In another specimen preserving a portion of the shell, fine concentric lines of growth with more closely arranged longitudinal ridges are visible.

Geological Formation and Locality. In the shales above the Galena limestone, on Makoqueta creek in Iowa, and also on the east side of the Mississippi River, the particular locality unknown.

Collector. Dr. Thomas Scott, of Dubuque, Iowa.

Dedicated to Prof. J. D. Whitney.

CYRTOCERAS NELEUM, (n. s.)

Description. Shell of small or medium size, very gradually expanding from the apex and strongly curved, transverse section circular, or sub-circular, very obtusely sub-angular on the back in casts, most ventricose on the ventro-lateral region. Septa closely but not evenly arranged, averaging about nine in a space equal to the transverse diameter of the shell, curving forward on the dorsal side, their margins undulated especially towards the outer chamber where they become crowded. On the ventral side the septa have a broad advancing curve. The exposed surface of the septa show the greatest concavity a little on the ventral side of the centre. Siphuncle dorsal, comparatively large.

Surface marked by transverse, slightly undulating annulations, which are strongly and abruptly curved backwards on the dorsum. Diameter of large specimens five-eighths of an inch.

✓ This species differs from *C. lamellosum*, Hall, 1847—*C. Halleanus*, D'Orbigny, 1850—*C. Billingsi*, Salter, 1859, (Canadian Organic Remains, Decade I.), not *C. lamellosum* of De Verneuil, 1842, in the more gradual and equal curvature, the much less rapid expansion, (the expansion being only one sixteenth of an inch in a length of one inch and a quarter), and in the position of the Siphuncle which is situated close to the dorsal side.

Geological Formation and Locality. In the "Buff limestone" at Beloit, and forty feet above the base of the Trenton limestone group, Platteville.

Collectors. T. J. Hale and James Hall.

CYRTOCERAS EUGIUM, (n. s.)

Description. Shell of medium size, strongly curved and very gradually expanding from the apex. Section oblate, very obtusely sub-angular on the back, rounded on the sides, and depressed convex on the ventral side, giving the form of section described, the transverse diameter of which is greater than the dorso-ventral diameter. Septa moderately convex,

gently curved forward on the dorsum, and nearly straight on the ventrum; the greatest concavity being a little on the ventral side of the centre. Seven septa measured on the back, occupy a space equal to the transverse diameter. Siphuncle small, dorsal.

Surface marked by concentric lines of growth.

This species is remarkable for the oblate, obtusely triangular section, and its very gradual depression towards the aperture, the amount of increase in a length of one and a half inches being scarcely more than one-tenth of an inch. In two specimens examined the septa are more distant and are not crowded towards the aperture as in the preceding species, nor are they bent forward on the ventral side. The siphuncle is proportionally smaller, and the specimens preserve no markings beyond the striæ of growth.

The specimens are casts and imperfect, the largest one having a diameter of three-fourths of an inch.

Geological Formation and Locality. In the "Buff limestone" of the Trenton limestone group, at Beloit, Wisconsin.

Collectors. T. J. Hale, James Hall.

CYRTOCERAS FOSTERI, (n. s.)

Description. Shell elongate arcuate, making less than a revolution, gradually tapering to the apex, sharply rounded on the dorsum, and less abruptly on the ventral side, compressed laterally, giving an elliptical section. Septa closely arranged, somewhat deeply concave, strongly arched forward on the dorsum; the space occupied by fine septa on the back of the shell scarcely equalling the transverse diameter at the same point. Siphuncle near the dorsal margin.

Surface characters unknown.

There are sixteen septa in the space of an inch and a half from the outer chamber, the last one being a little more approximate. The transverse diameter near the outer chamber is three-fourths of an inch, and the outer chamber, which is preserved for the length of less than an inch, continues to have the same gradual expansion as the septate portion.

This species differs from the *C. Whitneyi* in its more gradual increase in size, in being less compressed laterally, and in having the septa more regularly arranged or not increasing in distance with the age of the shell. The septa are likewise much more arched forward upon the back than in that species. There are no evidences of longitudinal striæ on the

cast or upon the enclosing matrix as in that one, and it is only in the general form that the two approach each other.

Dedicated to J. W. Foster, Esq.

Geological Formation and Locality. In limestone of the age of the Niagara group, near Chicago, Ill. Received from J. W. Foster, Esq.

CYRTOCERAS, LOCULOSUM, (n. s.)

Description. Shell robust, somewhat rapidly increasing in size and strongly curved, abruptly rounded on the dorsal and ventral sides and much compressed laterally, becoming distinctly bilobate towards the outer chamber from the deep rounded channel on each side, which is a little on the dorsal side of the middle.

In three specimens examined, the dorso-ventral diameter is nearly or quite twice as great as the transverse diameter in the outer portions of the shell, while on the older parts the diameters are more nearly equal, and the depressions upon the sides scarcely marked. Septa moderately concave, numerous, and sometimes very much crowded, strongly undulated across the depressions on the sides; strongly arched forward and produced on the back, the number ranging from sixteen to twenty-four in the space of an inch upon the back, while on the ventral side they are sometimes barely separated.

Position of the siphuncle and surface characters of the shell unknown.

This species is quite distinct from any other known to me, in the numerous crowded septa and the strong depressions along the sides, which occur in three specimens in the same relative position. The specimens are casts in magnesian limestone, and no remains of the surface markings are preserved.

Geological Formation and Locality. In limestone of the age of the Trenton group of New York, at Madison, Wisconsin.

Collector. T. J. Hale.

CYRTOCERAS ORCAS, (n. s.)

Description. Shell robust, moderately curved, rapidly expanding from the apex to the beginning of the outer chamber, beyond which it is gently contracted towards the aperture. One imperfect specimen of this species increases in its transverse diameter from seven-eighths of an inch to one inch and seven-eighths in a length of two inches. The section is transversely oval, the diameter being as ten to eleven and a half. Septa moderately concave, distant, from five to six in a space

equal to the transverse diameter of the specimen at the same point; having a broad, shallow, retral undulation on the dorsal side. Siphuncle dorsal small where it passes through the septa, and enlarging within the chambers.

Surface longitudinally striated.

This species is readily recognized, and distinguished from any others in the same association by its great expansion, and by its distant septa, as well as in having the transverse diameter greater than the dorso-ventral diameter. Length from four to six inches or more.

Geological Formation and Locality. In limestone of the age of the Niagara group, Racine, and at Waukesha, Wisconsin.

CYRTOCERAS DARDANUM, (n. s.)

Description Shell robust, strongly curved, moderately expanding from the apex, and slightly contracting near the aperture; transverse section broadly elliptical, the greater diameter in a dorso-ventral diameter. Dorsal and ventral sides equally rounded. Septa distant, measuring only four in a distance equal to their transverse diameter, deeply concave, and strongly arched forward on the dorsum. The siphuncle of moderate size, dorsal.

Surface apparently smooth or with only lines of growth, the small remains of the shell showing no markings. The length of entire individuals has been from six to eight inches.

The specimens examined are casts of imperfect individuals, but they are so well marked as to be easily recognized.

Geological formation and locality. In limestone of the age of the Niagara group, at Waukesha, Wisconsin.

GENUS ONCOCERAS, HALL.

In the first volume of the Palaeontology of New York, I have proposed a separation of the forms like *Cyrtoceras*, when the aperture is abruptly constricted, and the apex more abruptly tapering from the middle of the shell. Some of the forms are much like curved *Gomphoceras*, with a more extended apex. The section is usually broadly elliptical and the siphuncle dorsal, or on the outer side of the curve.

The contraction towards the aperture is often extreme, and in all individuals which I have seen, this feature is strongly marked. The genus is at least convenient for the reference of species of this peculiar type.

ONCOCERAS ABRUPTUM, (n. s.)

Description. Shell small, gradually expanding from the outer chamber, and contracted again at the aperture. Very little curved, transversely round-oval, the greatest diameter being in a dorso-ventral direction, the two diameters being as seven and eight. Septa but little concave, not very distant, there being nine in the length of three-fourths of an inch from the outer chamber, counting on the side. Siphuncle dorsal.

Surface marked by longitudinal ridges, the remains of which are preserved on the cast.

This description is drawn from two fragments, one of which is nearly an inch and a half long, retaining eleven of the septa and a portion of the outer chamber; but the abrupt expansion of the shell, together with other characters, are sufficient to distinguish it from any described species. The transverse diameter of one fragment, where broken off, at the smaller end is seven-sixteenths of an inch, and at a distance of three-fourths of an inch it has increased to a diameter of seven-eighths of an inch.

From the *O. constrictum*, of the Trenton limestone of New York, it differs in its more closely arranged septa, which are not arched forward on the dorsum as in that species, and also in its greater proportional transverse diameter.

Geological Formation and Locality. In the Trenton limestone group, at Platteville, and in the same position at Beloit, Wisconsin.

ONCOCERAS PLEBEIUM, (n. s.)

Description. Shell of medium size, rapidly expanding in the apical half, less rapidly in the middle, and again contracting near the aperture. Transverse section ovate, the diameter as seven to eight and a half, the longest diameter in the dorso-ventral direction, narrowest at the dorsum. Septa at medium distance, there being six in a space equal to their lateral diameter, little arched forward on the back, and but moderately concave. Siphuncle dorsal, of medium size, expanded in the chambers.

Surface unknown.

This species is subject to some variation in its curvature at different stages of growth, and also in the transverse diameter, some specimens being more compressed than others. It resembles *O. constrictum*, of the Trenton limestone of New York, in the unequal expansion, and in the flatness of the septa; but the expansion is not so abrupt, and the transverse section is proportionally much narrower.

Geological Formation and Locality. In the Buff limestone of the Trenton limestone group, at Beloit.

Collectors. Prof. Nason, E. Hobart T. J. Hale.

ONCOCERAS PANDION, (n. s.)

Description Shell robust, strongly curved, very rapidly expanding to near the outer chamber, which gently decreases in size for nearly two-thirds of its length, and then becomes suddenly constricted to nearly half its former dimensions; broadly ovate or sub-circular, the diameter in the dorso-ventral direction. Septa moderately distant, strongly curved forwards on the dorsal side, the greatest concavity on the ventral side of the centre. Siphuncle large, dorsal.

Surface unknown.

This species most nearly resembles in form the *O. constrictum* of any species yet found in Wisconsin. The differences consisting in the greater proportional transverse diameter, the absence of a prominent or ventricose space on the ventral side at the point of greatest diameter, the greater concavity of the septa, and the more sudden contraction of the aperture.

Geological Formation and Locality. In "Buff limestone" of the Trenton limestone group, at Beloit, Wisconsin.

ONCOCERAS LYCUM, (n. s.)

Shell somewhat gently curving, gradually expanding from the middle to the outer chamber, which is marked by a broad, deep constriction just posterior to the aperture, the margin of which is expanded or sub-reflex. Transverse section very broadly ovate, the diameters as nine and ten, the longest being in the dorso-ventral direction; very obtusely sub-angular on the back. Septa slightly concave, about a line apart, one or two of the outer ones a little more approximate. Siphuncle of medium size, expanded within the chambers, placed at about its own diameter within the dorsal margin. Length of fragments one to two inches. Entire length of larger specimens, three or four inches.

This species bears some resemblance to *O. pandion* in the form of the transverse section, and the constriction near the aperture, but differs in the curvature of the shell, and in having less concave septa and position of the siphuncle.

Geological Formation and Locality. In the "Buff limestone" of the Trenton limestone group.

ONCOCERAS ALCEUM, (n. s.)

Description. Shell robust, nearly straight or but slightly arcuate, rapidly expanding from the middle of the shell and swelling out more abruptly at the distance of an inch below the outer chamber, which gradually diminishes towards the aperture and constricted behind the margin. Transverse section elliptical, the longest diameter being as nine to twelve and a half. Septa about seven or eight in the space of an inch, very slightly concave. Siphuncle large, slightly inflated between the chambers, dorso-lateral or dorsal, being on the margin, half way between the line of the transverse and longitudinal diameters.

Some remains of strong lamellose striæ of growth are preserved on the outer chamber. Length preserved, two and a half inches; the greatest diameter a little more than one and a quarter inches.

This species is remarkable for the straightness of the shell, and the elongate-elliptical form of the section. The position of the siphuncle may be considered as dorsal, it being upon the outside of the curve, the inner side of the curve and greatest attenuation of the septa being opposite. At first sight the position of the siphuncle appears to be due to distortion, but the relations of the parts have not suffered, and it does not seem possible that it could have been moved by pressure without distorting the form and proportions of the parts.

Geological Formation and Locality. In the "Buff limestone" of the Trenton limestone group, at Beloit, Wisconsin.

ORTHOCERAS GREGARIUM, (n. s.)

Description. Shell of medium size, gradually expanding from the apex; transverse section circular. Septa deeply concave, not very distant, varying from six to nine in the space of an inch, according to age. Siphuncle central in young specimens, often becoming sub-central or quite excentric in old individuals.

Surface smooth except fine concentric lines of growth.

This species somewhat resembles some specimens of *O. proteiforme* of the Trenton limestone of New York; but it differs in the uniformly smaller size, greater concavity of septa, and more central siphuncle; while in that species the siphuncle is sub-marginal.

Geological Formation and Locality. Abundant in the lower part of the shales above the Galena limestone; at Makoqueta

creek, in Iowa; at Scales Mound, in Illinois; and, more rarely, in the beds of which this group have been penetrated in the mining district of Wisconsin.

ORTHOCERAS PLANOCONVEXUM, (n. s.)

Description. Shell of medium size, gradually expanding from the apex towards the outer chamber, plano-convex; transverse section semi-circular or sub-triangular, the diameter as five to nine. The convex side is a little depressed on each side of the middle, the opposite side nearly flat, the edges abruptly rounded. Septa moderately concave, arching upwards on the sides, somewhat closely arranged, about five in half an inch. Siphuncle small, central. A specimen of the outer chamber, apparently of this species, is a little more than two and a half inches in length, and one inch and an eighth in width, the short diameter being half an inch; the septa are about one-tenth of an inch distant.

Surface unknown.

Geological Formation and Locality. In the Buff limestone of the Trenton limestone group, at Mineral Point and Beloit, Wisconsin.

GONIOCERAS OCCIDENTALES, (n. s.)

Description. Shell elongate, very compressed, extremely expanded laterally, the upper part with curved outline, beyond the middle the edges are more nearly parallel; the length (when entire,) having been a little less than twice the greatest diameter. Upper and lower surfaces convex, the one twice as convex as the other; the two diameters as one to seven; lateral expansions very thin. Septa deeply concave, numerous, closely arranged, twelve to the inch in the central lobe; arching forwards on the sides with a sharp retral curve a little within the margin, and running backwards in a narrow extension to the edge at a point opposite or below their junction with the siphuncle in the central lobe. Siphuncle oblate, of medium size where passing through the septa, expanding in the chambers to more than one half the smaller diameter of the shell, somewhat bilobate from a constriction above and below.

Surface apparently smooth, or with only concentric lines of growth.

This species differs from *G. anceps*, of the New York rocks, in the less rapid and irregular lateral expansion from the apex, in being thinner in proportion to the breadth, in the more reg-

larly convex sides, and in the form of the septa, which are more deeply concave in the middle lobe; this part being narrower in proportion to the entire breadth. In the lateral expansions or outer lobes the septa are recurved towards the apex, and gradually approach each other towards the margin; while in the *G. anceps* they make a gentle backward curve and terminate on the edge at nearly their full width.

Geological Formation and Locality. In limestone of the age of the Trenton group, at Platteville, Wisconsin.

GENUS THECA, Sow.

THECA PRIMORDIALIS, (n. s.)

Description. Shell elongate, gradually tapering to the somewhat obtusely pointed apex. Transverse section sub-triangular or plano-convex, the diameters about as two to one; length of shell about three and a half times as great as the width of the aperture; one side very slightly convex or nearly flat, the opposite side often regularly rounded, sometimes a little angular along the centre. Aperture transverse, the margin on the flat side extended and forming a semi-circular lip; that of the convex side transverse to the axis of the shell with sometimes a slight emargination near the middle.

Surface marked by fine lines of growth parallel to the margin of the aperture, and also on the flat side by numerous strong undulations following the lines of growth. The shell, where preserved, is apparently phosphoric, having the same texture and appearance as the Lingulæ, with which it is associated; but it is more readily decomposed. It sometimes attains a length of one inch and a quarter.

Geological Formation and Locality. Potsdam sandstone, Trempeleau, Wisconsin, and Chippewa River.

GENUS SERPULITES, McLEAY.

SERPULITES MURCHISONIA, (n. s.)

Description. Body elongate, extremely compressed, very gradually tapering to the acutely pointed apex, gently curved throughout its entire length. Both sides (as they are imbedded in the sandstone,) very depressed convex, with the aperture prolonged on the inner side of the curve,

Surface of both sides marked by fine transverse lines of growth, and by numerous strong somewhat equidistant undulations, parallel to the margin of the aperture. Length of a

large individual two and a half inches, with a transverse diameter at the aperture of three-tenths of an inch.

The specimens of this species may have been circular when living, as the prolongation of the margin of the aperture would indicate, this not always having the same relative position, and the greatest extension being sometimes half way between the inner and outer angle. In these specimens the curvature is not quite as great as in those where it is marginal, which would indicate a tubular shell flattened in a direction oblique to the plane of the curvature.

Geological Formation and Locality. In some dolomitic layers of the Potsdam sandstone, at LaGrange mountain, Minnesota.

GENUS ILLÆNUS, DALMAN.

ILLÆNUS IMPERATOR, (n. s.)

I have fragments of a large Illænus, of the age of the Niagara group, distinguished chiefly by its broad, flattened caudal shield.

Description. Caudal shield very broad, nearly flat for the anterior half of its length; the middle lobe rising less than an eighth of an inch above the lateral lobes; dorsal furrow forming a shallow depression which expands about one-third of the length of the pygidium. Middle lobe of the thorax broadly rounded and very moderately convex; lateral lobes flattened for a space equal to half the width of the central lobe, and thence bending backwards at an angle of about thirty degrees.

A single imperfect specimen measures across the pygidium four and a half inches, with a length (on the curve) of three inches. The middle lobe of the thorax is one inch and three-fourths in width near the posterior end, and the four posterior segments measure one inch along the middle of the axis.

Geological Formation and Locality. In limestone of the age of the Niagara group, at Racine, Wisconsin.

Collector. T. J. Hale.

ILLÆNUS TAURUS, (n. s.)

Description. Ovate, distinctly trilobed; the central lobe fully once and a half as wide as the lateral lobes. Head large, gibbous, extremely arched; the dorsal furrows continued but little more than one-fourth its length, distant from each other a little more than one-third the entire width of the head; anterior margin straight to a point a little beyond the suture line on each side; cheeks making a little less than one-sixth of the

entire width of the head, measured on the curve, the anterior margin slightly sinuous near the suture. Eyes close to the posterior margin, large, conical, the palpebral lobe projecting laterally at right angles to the axis; genal angles rounded.

The thorax has ten segments, the axis regularly and moderately convex, its sides gradually converging to the pygidium; the lateral lobes have a flat space outside of the dorsal furrow, reaching to the fulcrum of the pleura, which is equal to one-third the width of the axis; at this point the pleura bend abruptly downwards. The pygidium has less than half the area of the head, broadly rounded on the posterior side and broadly truncated laterally, almost at right angles to its anterior margin.

A single entire specimen only has been seen; and this gives the following measurements:

Entire length of a rolled specimen, measured on the curve, four and a quarter inches: of this the head measures more than two inches; its direct length being one inch and three-eighths. The thorax and pygidium measure two and a half inches; the width of the head to the extremities of the eyes, measures two and a quarter inches.

Geological Formation and Locality. In the "Buff limestone" of Beloit, and at Mineral Point, Wisconsin. I have also seen the same species from Rockford, Illinois.

I am indebted to Rev. John Murrish, of Linden, for a very fine specimen.

GENUS CALYMENE, DALMAN.

CALYMENE MAMMILATA, (n. s.)

Description. Form of the entire body unknown. Cephalic shield broadly semi-elliptical, the posterior margin nearly straight, the anterior border extended in front of the glabella in a broadly rounded, thickened projection, which is abruptly recurved at the margin, and marked on each side by a mamilliform tubercle about half way between the antero-lateral angle of the glabella and the edge of the border. The glabella is proportionally small, broad at base, rounded in front, lobed at the sides by three pairs of transverse furrows; the posterior lobes extend about one-third across the glabella, and are directed backwards, forming two rather large tubercles; the two anterior pairs are small, and extend but a short distance from the margin of the glabella. The centre of the glabella is prominent, the sides nearly parallel to the anterior angles, which are slightly extended laterally; occipital furrow distinct, bent forward in the middle. Cheeks very prominent, giving

great depth to the furrows which divide them from the glabella; the lateral borders thickened with a rounded margin. On the inside of the projecting border, in front of the glabella, there are two large rounded tubercles, which form a conspicuous feature.

Pygidium semi-elliptical, the central lobe or axis not very prominent, marked by seven annulations besides the terminal one, which is nearly as long (wide) as the three preceding, obtusely rounded posteriorly: the lateral lobes are broad, nearly twice the width of the central lobe at its junction with the last thoracic segment; marked by six broad flattened ribs, which become obsolete before reaching the margin; the anterior five are divided in the middle or on the outer half of their length, by a narrow sulcus.

Surface of the whole crust of the body, so far as seen, covered with fine rounded papillæ.

This species somewhat resembles *C. diademata*, Barr., but the glabella is much narrower in front, the two anterior pairs of lobes in the sides are much smaller, the cheeks more prominent, and the projection in front of the head much more extended; also, the two rounded tubercles, characteristic of this species, are not possessed by that one. The pygidium is narrower, and has one annulation more than *C. diademata*.

Geological Formation and Locality. In the shales above the Galena limestone, Makoqueta creek, twelve miles west of Dubuque, Iowa.

Collector. T. J. Hale.

GENUS DALMANITES, EMMERICK.

DALMANITES VIGILANS, (n. s.)

Description. General form of body not determined. Cephalic shield convex, semi-elliptical, the breadth about twice as great as the length, (exclusive of the frontal projection,) the border extended in front into a triangular flattened process, the base of which is little less than one-half as wide as the width of the anterior portion of the glabella. In older individuals this projection becomes more obtuse and sometimes rounded, the lateral borders are broad, flattened, separated, from the cheeks by a distinct groove, extended posteriorly into spines which are equal in length to the glabella.

Glabella large depressed convex, widening in front to twice the width of the posterior margin; divided into lobes by three pairs of transverse furrows exclusive of the occipital furrow, which is distinct and continuous: the two posterior furrows

are distinct at the sides, but do not extend entirely across the glabella except in very faint depressions; the anterior furrows are deep, very distinct, situated a little anterior to the eyes, extending each about one-third across the glabella, and giving to the frontal lobe a transversely elliptical outline.

The occipital ring is narrow, ornamented on the middle by a single, short, sharp spine. Eyes very prominent; short reniform, containing about thirty-five vertical ranges of lenses, the middle ones of which have nine each. Cheeks small, prominent on the anterior portion; marked near the posterior margin by a deep groove, the continuation of the occipital furrow. Thoracic segments unknown.

Pygidium somewhat elongate triangular, extended posteriorly into an acute spine; central lobe or axis marked by ten or twelve narrow rings; the lateral lobes less prominent, marked by ten flattened ribs, which terminate in a narrow, flattened margin; eight of these ribs are double throughout their entire length; the posterior ones are directed obliquely backwards.

This species somewhat resembles *D. limuluris*, (*Phacops limuluris*, Pal. N. Y., Pl. 67, fig. 1); but differs in the proportionally larger glabella, the larger and more prominent eyes, and the extension of the anterior border; the pygidium is less rounded on the anterior margin, the spine is more obtuse, the flattened margin outside of the ribs is narrower, and the number of ribs on the lateral lobes is greater.

Geological Formation and Locality. In Niagara limestone, at Waukesha.

Collectors. I. A. Lapham, T. J. Hale, James W. Hall.